

ADDITIONAL NOTES ON CAVE SHRIMPS
(CRUSTACEA: ATYIDAE AND
PALAEMONIDAE) FROM THE
YUCATÁN PENINSULA,
MÉXICO

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Abstract.—The troglobitic shrimps of the Yucatán Peninsula are represented by three species of atyids and a single palaemonid: *Typhlatya campechae* Hobbs and Hobbs, *Typhlatya mitchelli* Hobbs and Hobbs, *Typhlatya pearsei* Creaser, and *Creaseria morleyi* (Creaser). These shrimps are found in the states of Campeche, Quintana Roo, and Yucatán and the localities in which specimens have been observed are listed. In addition to a summary of the distribution, observations concerning species variations and life history data are noted along with ecological considerations for each species. Several populations of *T. mitchelli* are known to have melanistic representatives and a discussion of the pattern of pigmentation is presented.

Introduction.—Creaser (1936, 1938) initiated a study of the troglobitic shrimp fauna of the Yucatán Peninsula when he reported on the crustaceans collected by him during the 1932 University of Michigan Yucatán Expedition. He (1936) described *Palaemon morleyi* (= *Creaseria morleyi*) from San Isidro Cave (= Cenote de San Isidro) and *Typhlatya pearsei* from Balaam Canche Cave [= Grutas de Balankanche]. It was not until 1976 that other shrimp species were reported from the Peninsula. Hobbs and Hobbs (1976), working primarily with specimens collected during 1973 by James R. Reddell (University of Texas at Austin) and associates, described two new species of the genus *Typhlatya*, *T. campechae* and *T. mitchelli*, and reported many new locality records for the previously known shrimps, *T. pearsei* (Atyidae) and *C. morleyi* (Palaemonidae). In late 1974 and mid-1975 Reddell made additional expeditions to the Peninsula and as a result of his efforts, our knowledge of the troglobitic shrimp fauna has increased considerably (see Reddell, 1977). In addition, Holthuis (1977) provided a description and listed new locality records for pigmented specimens of *T. mitchelli*.

This paper treats collections of melanistic specimens of *T. mitchelli*. Also, synonymies (only additions to those by Hobbs and Hobbs, 1976) are presented for the four troglobitic shrimps occurring in the State of Yucatán. Summaries of the distribution and observations concerning variations are noted along with ecological considerations for each of them. Life history data are tabulated in Table 2 and reflect the bias in sampling since 1932.

The reader is referred to Hobbs and Hobbs (1976) for descriptions of the atyids and to Holthuis (1952) for a description of the palaemonid, *C. morleyi*. For information concerning geology, physiography, and cave and karst development in the Yucatán Peninsula, see Butterlin and Bonet (1936), Finch (1973), West (1964), Isphording (1975), and Isphording and Wilson (1973).

Acknowledgments.—I am grateful to James R. Reddell for not only making specimens available for examination, but also for his assistance in plotting cave entrance locations and for information concerning the ecology of the shrimps.

I am also indebted to Lipke B. Holthuis of the Rijksmuseum van Natuurlijke Historie, Leiden, Netherlands, for informing me of his recent work on the cave shrimps from Mexico. I extend my appreciation to Horst Wilkens of the Zoological Institute of the University of Hamburg, West Germany, for notifying me of the disposition of the shrimp specimens he collected during the third Biospeleological Expedition to Mexico by the Accademia Nazionale dei Lincei.

I am most grateful to my father, Horton H. Hobbs, Jr., for initially directing me in the study of these shrimps and for his criticisms and aid in the preparation of this manuscript.

Listed below, alphabetically, are the collectors of the specimens examined (initials are used to identify them in the species treatments). Especial thanks are extended to those persons who spent considerable time in the Peninsula caves collecting shrimps.

Francis E. Abernethy—F.E.A., E. W. Andrews—E.W.A., R. Argano—R.A., Mary Butterwich—M.B., Jerry W. Cooke—J.W.C., E. P. Creaser—E.P.C., Deborah Denson—D.D., Linda Elliott—L.E., M. Cárdenas Figueroa—M.C.F., Andy Grubbs—A.G., F.G. Hall—F.G.H., Masaharu Kawakatsu—M.K., David McKenzie—D.M., Martha H. McKenzie—M.H.M., Robert W. Mitchell—R.W.M., S. R. Mitchell—S.R.M., Sharon A. Mitchell—S.A.M., Stuart Murphy—S.M., A. S. Pearse—A.S.P., Terry Raines—T.R., James R. Reddell—J.R.R., William H. Russell—W.H.R., E. H. Sallee—E.H.S., Reynaldo Solis—R.S., B. F. Osorio Tafall—B.F.O.T., Suzanne Wiley—S.W., and H. Wilkens—H.W.

Suborder Natantia
Section Caridea
Family Atyidae
Genus *Typhlatya*

Typhlatya campecheae Hobbs and Hobbs

Typhlatya campecheae Hobbs and Hobbs, 1976:6, 7 (fig. 3), 8, 9 (fig 4), 10, 14–16, 20 (Appendix), 21 (Map 1).—Buden and Felder, 1977:114.—

Hobbs, Hobbs, and Daniel, 1977:iii, 6, 8, 11, 12, 24, 32, 33 (fig. 7), 34 (fig. 8).—Reddell, 1977:230, 240 (Table 1) 241, 243, 249.—Holthuis, 1977:174.

Type-locality.—Grutas de Xtacumbilxunam (=Grutas de Ixtacumbilxunan; Grutas de Xtacumbilxunan), 2 km SW Bolonchenticul, Campeche, Mexico.

Distribution.—Campeche, Mexico. Known from the type-locality and from Cenote de Cantemo, 1 km N Cantemo, Campeche, Mexico.

Specimens examined.—217 specimens have been examined from Campeche, Mexico; locality numbers in parentheses correspond to the locality numbers in Table 1 and Figure 1. (5) Type-locality, 1♂, 4♀, 2♀ ovig., 19 April 1973, and 40♂, 109♀ and 21 juv., 13 May 1973, M.B., D.M., M.H.M., S.M., and J.R.R., coll. (2) Cenote de Cantemo, 18♀, 18 Dec. 1974, L.E., D.M., and J.R.R., coll.; 22♀, 31 July 1975, A.G., D.M., J.R.R., and S.W., coll.

Ecology.—*T. campecheae* has been found only in lentic environments in these two caves. In the type-locality it frequented guano-floored pools, and in Cenote de Cantemo it inhabited a pool 1.5 m deep and 3 m in diameter, floored with organic debris, the surface being covered with a thin layer of oil (see Reddell, 1977 for descriptions of the caves and for faunal associates; see Table 2 for life history data).

Color.—Preserved specimens are translucent to white, totally lacking pigments.

Variations.—Hobbs and Hobbs (1976:10) discussed variations in the population from the type-locality. No additional variations were observed in the specimens examined from Cenote de Cantemo.

Typhlatya mitchelli Hobbs and Hobbs

Typhlatya mitchelli Hobbs and Hobbs, 1976:2, 3 (fig. 1), 4, 5 (fig. 2), 6, 10, 14, 15, 16, 20 (Appendix), 21 (Map 1).—Buden and Felder, 1977:114.—Hobbs, Hobbs, and Daniel, 1977:iii, 6, 8, 11, 12, 25, 39, 40 (fig. 12), 41 (fig. 13), 45.—Reddell, 1977:230, 239, 240 (Table 1), 251, 255, 256, 260, 262, 263, 268, 279, 281, 289, 291, 292, 293.—Holthuis, 1977:173–176 (fig. 1a–i), 177, 178 (fig. 2), 179–181, 194.

Type-locality.—Cenote Kabahchén (=Actún Caba Chen), in the town of Muni, Yucatán, México.

Distribution.—This species is known from the states of Quintana Roo and Yucatán (Northwestern and Northeastern Coastal Plain physiographic districts).

Specimens examined.—A total of 55 specimens, the majority females, have been collected from the states of Quintana Roo and Yucatán; those specimens marked by an asterisk were not examined by the author; locality

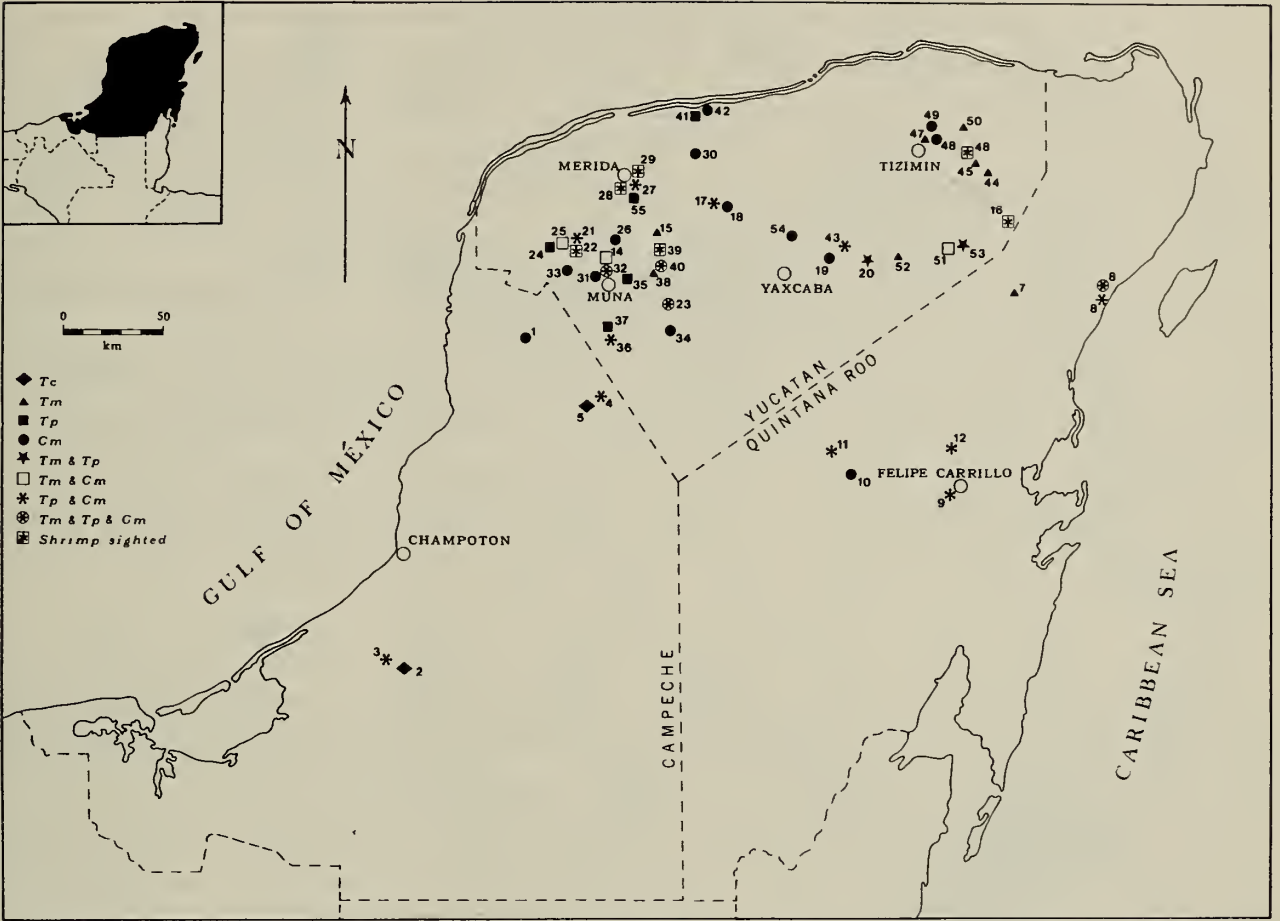


Fig. 1. Distribution of the troglobitic shrimps (Atyidae and Palaemonidae) in the Yucatán Peninsula, Mexico. Location of the entrance to Cueva Coop (No. 13) not shown. Tc = *Typhlatya campecheae*; Tm = *Typhlatya mitchelli*; Tp = *Typhlatya pearsei*; and Cm = *Creaseria morleyi*.

numbers in parentheses correspond to the locality numbers in Table 1 and on Figure 1. QUINTANA ROO: (6) Curva del Fermin, 3 km E Pamul at Rancho San Martín, 2♀, 3 July 1975, A.G., D.M., and J.R.R., coll. (7) Actún Ha, located in the ruins of Cobá, 2♀, 30 June 1975, A.G., D.M., J.R.R., and S.W., coll. YUCATÁN: (14) Cenote de la Culebra, 20 m W of México Hwy 180, midway between km 175 and 176, 1♀, 1J, 27 March 1973, J.R.R., coll. (15) Cenote Chun Kopac (=Cenote Acanceh) Acanceh, 1♀, 8 October 1974, J.R.R., coll. (20) Actún Kaua, 1 km S Kaua, 1♀, 11 December 1974, A.G., D.M., J.R.R., and S.W., coll. (23) Type-locality, 5♀ plus holotype, 1 August 1973, M.K., R.W.M., and J.R.R., coll. (25) Cenote Calchuhim (= ? Cenote Calchuntunil), 2 km E Hacienda San Bernardo, 6♀, 15 October 1974, J.R.R., R.S., and S.W., coll. (32) Cenote del Pochote (=Cueva de Caxcuy, Cueva del Ponte, Cueva del Pochote), 10 km NW Muna, 8♀, 4 November 1974, D.M., J.R.R., and S.W., coll. (38) Cenote Chen Mul (=Cenote Ch'en Mul), located at the base of the great pyramid in the Ruins of Mayapán, 2♀, 26 April 1973, M.B., D.M., M.H.M., and

J.R.R., coll. (40) Grutas de Tzab-Nah (=Grutas de Dzab-Nah), 2 km S Tecoh, 3♀, 6 August 1973, D.D., R.W.M., S.A.M., and S.R.M., coll. (44) Cenote Aká Chen, 1 km E Tixcancal, 3♀, 2 April 1973, M.B., D.M., M.H.M., S.M., and J.R.R., coll. (45) Cenote de Orizaba (=Cueva de Orizaba), 8 km S Buenaventura, 1♀, 1 April 1973, M.B., D.M., M.H.M., S.M., J.R.R., coll. (47) Cenote Sodzil, 5 km W Sucopo, 5♀, 31 March 1973, D.M., M.H.M., S.M., and J.R.R., coll. (50) Cenote Zaci*, near the highway from Tizimin to Colonia Yucatán and El Cuyo, 36 km from Tizimin, 3 specimens*, March 1975, H.W., coll. (51) Cenote de la Paca, 7 km E Tikuch, 2♀, 11 April 1973, S.M., coll. (52) Cenote Xkeken, 3 km N Dzit-Nut, 4♀, 10 December 1974, D.M. and J.R.R., coll.; 1 specimen*, March 1975, H.W., coll. (53) Cenote Xtacabihá (=Cenote Xalau = Cenote de Xtacabihá) 9 km NNE Tikuch, 2♀, 11 April 1973, M.H.M., S.M., and J.R.R., coll.; 1♀, 6 July 1975, A.G. and J.R.R., coll.

Ecology.—*Typhlatya mitchelli* has been collected from 2 localities in Quintana Roo and 15 from Yucatán; “atyid shrimp,” among which this species may have been represented, have been observed but not captured from four additional cenotes in Yucatán (see Reddell, 1977:257, 262, 279, 290). In all localities shrimps were living in lentic situations varying from very small shallow (less than 0.3 m depth) pools to extensive underground lakes (greater than 2.0 m depth). Pearse (1938:12) reported an “inner pool” of Actún Kaua to have a temperature of 24.5°C on 17 June 1936. Generally the pools were in total darkness, but *T. mitchelli* occurs in entrance areas that receive direct light from the surface (e.g. Grutas de Tzab-Nah). Substrates of the pools consisted of guano, silt, organic debris, rocks and combinations thereof. Shrimps were found on the substrate, “hanging” from submerged walls along the edges of lakes, free-swimming, and among dense, branched root systems hanging down from the roofs of cenotes. Holthuis (1977:181) states, “The finely branched root systems of trees or other plants exposed in the water are among the favourite [sic] habitats of small atyids all over the world, whether subterranean or epigean.”

For a discussion of the fauna found in association with *T. mitchelli* see Reddell (1977) and Table 1. See Table 2 for life history data.

Color.—Hobbs and Hobbs (1976:4) in describing *T. mitchelli* noted that all the preserved specimens they examined (25) were “translucent to white.” On 6 July 1975 James Reddell et al. made an additional collection of shrimps from Cenote Xtacabihá. Unlike those captured on their first visit (11 April 1973), these specimens were pigmented. Shortly after I examined the most recent collection and also a pigmented series from Cenote Xkeken, I received a letter from Horst Wilkens in which he mentioned that he had collected pigmented specimens of *T. mitchelli* from two localities in Yucatán and had sent them to Lipke Holthuis. Correspondence with Dr. Holthuis indicated that he was treating these specimens in his manuscript on the

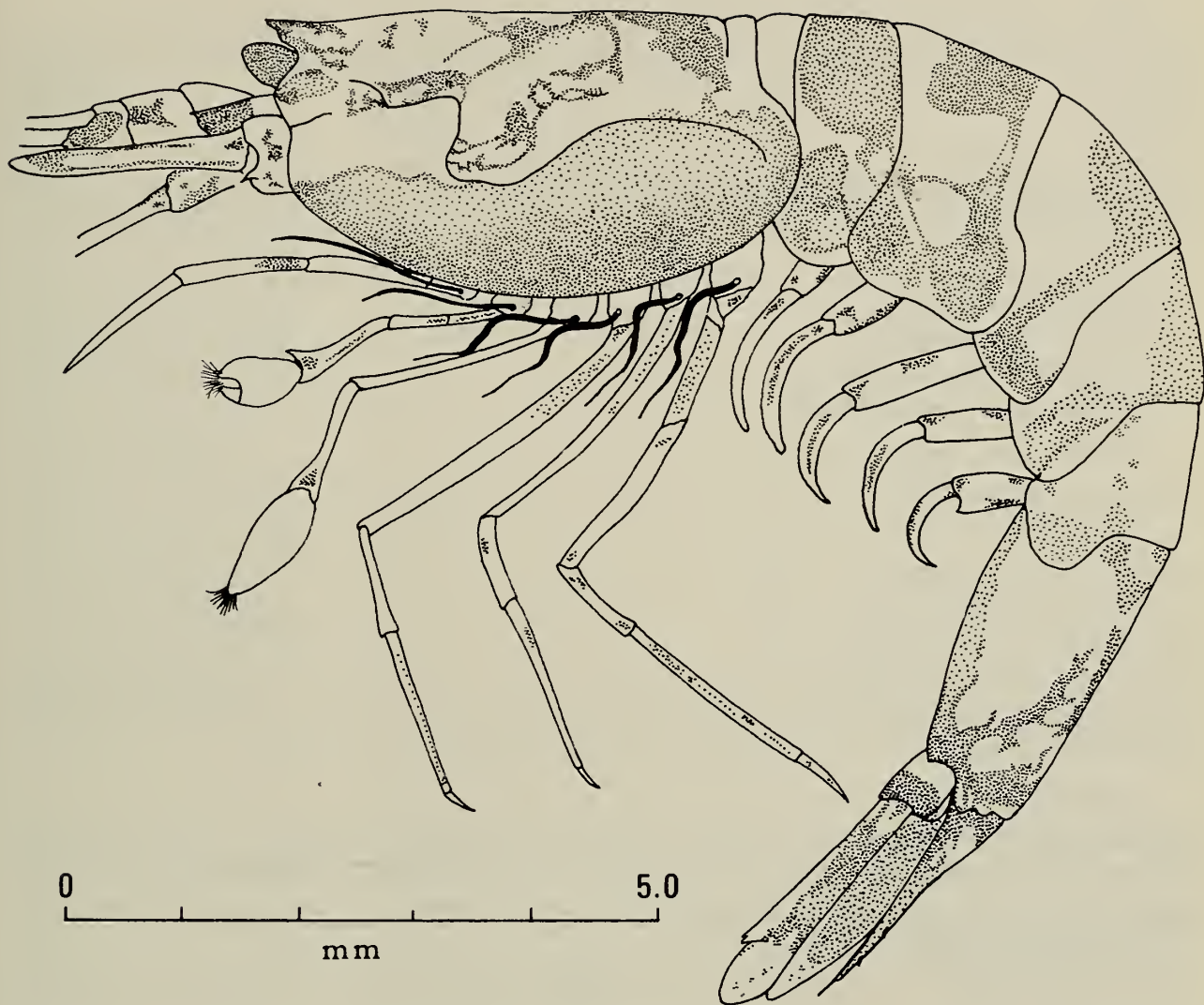


Fig. 2. Lateral view of melanistic female specimen of *Typhlatya mitchelli* from Cenote Xtacahiba showing color pattern.

subterranean shrimps of the Italian Mexico Expedition 1973 (see Holthuis, 1977:175–181). In this paper, Dr. Holthuis not only indicated the coloration of this shrimp but also figured and described the male of the species.

Figure 2 is a lateral view of a melanistic female specimen (4.2 mm carapace length) from Cenote Xtacahibá, showing the characteristic “dark chromatophore-like specks” (Holthuis, 1977:180) characteristic of specimens from the three cenote localities. The pigment appears greyish to black in preserved specimens (brown in a few specimens) and is particularly distinct along the ventral margin of the carapace, the rostrum, the eye-remnant (pigmented but not faceted), the first abdominal tergum, and the antennular peduncle (see Holthuis, 1977:180 for additional remarks concerning pigmentation). It is noteworthy that after being preserved in 70% ethanol for more than five years, the pigment is still easily observed in the specimens.

Variations.—No significant variations were noted in the specimens examined from localities other than those listed in Hobbs and Hobbs (1976).

Table 1. Distribution of troglobitic shrimps from the Yucatan Peninsula, Mexico.

Localities	Atyidae			Palaemo- nidae
	<i>T. campecheae</i>	<i>T. mitchelli</i>	<i>T. pearsei</i>	<i>C. morleyi</i>
CAMPECHE				
1. Cenote de Bolchen	—	—	—	+
2. Cenote de Cantemo	+	—	—	—
3. Grutas de Monte Bravo	—	—	+	+
4. Grutas de San Antonio	—	—	+	+
5. Grutas de Xtacumbilcunam	+	—	—	—
QUINTANA ROO				
6. Cueva del Fermin	—	+	+	+
7. Actun Ha	—	+	—	—
8. Pozo de San Martin	—	—	+	+
9. Cenote de Juan Coh	—	—	+	+
10. Cenote de Las Ruinas	—	—	—	+
11. Cenote de Santo Domingo	—	—	+	+
12. Cenote de Tos Virlol	—	—	+	+
13. Cueva Coop	—	—	+	+
YUCATAN				
14. Cenote de la Culebra	—	+	—	+
15. Cenote Chun Kapoc	—	+	—	?
16. Cenote de San Diego	—	?	?	—
17. Cenote de Hoctun	—	—	+	+
18. Cenote X-ebiz	—	—	—	+
19. Cueva Chac Mol	—	—	—	+
20. Actun Kaua	—	+	+	—
21. Cenote de las Abejas	—	—	+	+
22. Cenote de Sambula	—	?	?	—
23. Cenote Kabahchen	—	+	+	+
24. Cenote Calchum	—	—	+	?
25. Cenote Calchuhum	—	+	—	+
26. Cueva Amil	—	—	—	+
27. Cenote de San Isidro	—	—	+	+
28. Cenote de San Jose	—	—	—	?
29. Cenote de Huolpoch	—	—	—	?
30. Cenote de Sambula	—	—	—	+
31. Cenote de Kankirixche	—	—	—	+
32. Cenote del Pochote	—	+	+	+
33. Actun Xpukil	—	—	—	+
34. Actun Gongora	—	—	—	+
35. Cenote Nohchen	—	—	+	—
36. Actun Chac	—	—	+	+
37. Actun Okobichen	—	—	+	?
38. Cenote Chen Mul	—	+	—	—
39. Cenote de Telchaquillo	—	?	?	—
40. Grutas de Tzab-Nah	—	+	+	+
41. Cueva de Santa Elena	—	—	+	—

Table 1. Continued.

Localities	Atyidae			Palaemo- nidae
	<i>T.</i> <i>campecheae</i>	<i>T.</i> <i>mitchelli</i>	<i>T. pearsei</i>	<i>C.</i> <i>morleyi</i>
42. Pozo de Santa Elena	—	—	—	+
43. Grutas de Balankanche	—	—	+	+
44. Cenote Aka Chen	—	+	—	—
45. Cenote de Orizaba	—	+	—	—
46. Cenote de los Pinos	—	?	—	—
47. Cenote Sodzil	—	+	—	—
48. Cueva Sodzil	—	—	—	+
49. Cueva Xconsacab	—	—	—	+
50. Cenote Zaci	—	+	—	—
51. Cenote de la Paca	—	+	—	+
52. Cenote Xkeken	—	+	—	—
53. Cenote Xtacabiha	—	+	+	—
54. Cenote Yunchen	—	—	—	+
55. Cueva Luchil	—	—	+	—

Holthuis (1977) described specimens from Cenote Zaci and Cenote Xkeken and indicated that the endopod of the first pleopod of the male is “oval with some hairs in the outer half.” He (p. 180) described the appendix masculina of the male second pleopod as “short and oval, but still longer than the appendix interna; it ends in three rather strong bristles.”

Typhlatya pearsei Creaser

Typhlatya pearsei.—Holthuis, 1977:173–176, 180, 181, 194, fig. 1j.—Reddell, 1977:230, 239–241, 243, 247, 251–252, 258, 260, 262, 263, 266, 277, 278, 281, 283, 285, 293, Table 1.—Buden and Felder, 1977:112.—Hobbs and Hobbs, 1976:1, 10–16, 20, 21, fig. 5, map 1, Appendix.—Hobbs, Hobbs, and Daniel, 1977:iii, 6, 7, 9, 12, 15, 24, 39, 43–45, figs. 3, 15, and 16.

Type-locality.—Grutas de Balankanche (=Cueva de Balaam Canche), 4 km E Chichén Itzá, Yucatán, México.

Distribution.—*T. pearsei* is the most widely distributed atyid on the Yucatán Peninsula, being known from 21 localities in the Northeastern and Northwestern Coastal Plain, the Sierra de Ticul, and the Sierra de Bolonchén physiographic districts in the states of Campeche, Quintana Roo, and Yucatán.

Specimens examined.—222 specimens have been collected from 23 localities in Yucatán, México; locality numbers in parentheses correspond to the locality numbers in Table 1 and Figure 1; specimens marked with an

asterisk were not examined by the author. CAMPECHE: (3) Grutas de Monte Bravo, 10 km NW Cantemo, 3♀, 19 December 1974, L.E., D.M., and J.R.R., coll. (4) Grutas de San Antonio, 10 km NNE Bolonchenticul, 2♂, 7♀, 3 November 1974, D.M., J.R.R., and S.W., coll.; 15♀, 23–24 November 1974, D.M., J.R.R., and S.W., coll. QUINTANA ROO: (6) Cueva del Fermín, 4♀, 3 July 1975, A.G., D.M., and J.R.R., coll. (8) Pozo de San Martín, 2.5 km E Pamul at Rancho San Martín, 4♀, 2 July 1975, J.R.R., coll. (9) Cenote de Juan Coh, Felipe Carrillo Puerto, 9♀, 1 juv., 4 July 1975, A.G., D.M., and J.R.R., coll. (11) Cenote de Santo Domingo, 5 km ENE kilometer 50, 8♀, 28 July 1975, A.G., D.M., and J.R.R., coll. (12) Cenote de Tos Virlool, 13 km S Señor, 1♀, 4 July 1975, A.G. and J.R.R., coll. (13) Cueva Coop, near village of Pamul, 120 km NE Felipe Carrillo Puerto, 1 specimen*, March 1975, H.W., coll. YUCATÁN: (17) Cenote de Hochtún (=Cueva de Hochtún), 1 km W Hochtún, 7♀, 16 March 1973, M.B., D.M., M.H.M., S.M., J.R.R., coll.; 1 specimen*, March 1975, H.W., coll. (20) Actún Kaua, 1 km S Kaua, 3♀, 20–21 October 1974, D.M., J.R.R., and S.W., coll. (21) Cenote de las Abejas, 2 km N Kopomá, 1♂, 2♀, 16 April 1973, D.M. and S.M., coll. (23) Cenote Kabahchén (=Actún Caba Chén), Mani, 5♀, 1 August 1973, D.M., S.M., and J.R.R., coll. (24) Cenote Calchun, 1 km E Hacienda San Bernardo, 1♂, 16 April 1973, D.M., S.M., and J.R.R., coll. (27) Cenote de San Isidro (=Cueva de San Isidro, Cenote de El Retiro), southern end of Calle 66, Mérida, 1♀, 21 March 1973, S.M. and J.R.R., coll. (32) Cenote del Pochote, no specimens examined, reported from this locality by Cárdenas (1950:156) and Nicholas (1962:173). (35) Cenote Nohchén, Sacalum, 4♂, 29♀, 18 June 1975, A.G., D.M., and J.R.R., coll. (36) Actún Chac (=Gruta de Chac), S of Kabah, 1♀, 24 November 1962, E.W.A., coll. (37) Actún Okobichén, 8 km SW Santa Elena, 1♂, 9♀, 15 November 1974, D.M., J.R.R., and S.W., coll. (40) Grutas de Tzab-Nah, 4♀, 4 juv., 22 April 1973, D.M. and J.R.R., coll. (41) Cueva de Santa Elena (=Cueva or Cenote de los Camarones), 4.8 km S Telchac Puerto, 1♀, 31 July 1932, E.P.C., coll.; 3♂, 24♀, 6 juv., 22 March 1973, J.R.R., coll. (43) Type-locality, 6♀, 24 June 1932, E.P.C. and A.S.P., coll.; 12♀, 2 juv., 28 June 1932, E.P.C. and A.S.P., coll.; 30♀, 1 juv., 30 June 1932, E.P.C., coll. (53) Cenote Xtacabihá, 8♀, 11 April 1973, D.M., M.H.M., S.M., and J.R.R., coll. (55) Cueva Luchil (=Cenote Luchil) 8 km SSE Mérida, 1♀, 25 July 1932, E.P.C., coll. (Creaser's label for the specimens reads "Tuchil-cave on Tixcal Hacienda, 14 km SE Merida, Yucatan" and is believed to be the same location as Cueva Luchil.)

Reddell (1977) mentions three caves (see Table 1) in which atyid shrimps were observed. It is highly improbable that they were members of *T. campecheae*, but it is likely that they belonged to either *T. mitchelli* or *T. pearsei*.

Ecology.—*Typhlatya pearsei* has been collected from 2 localities in Cam-

peche, 6 caves in Quintana Roo, and 15 localities in Yucatán. This species is found in lentic habitats ranging from small pools (less than 0.5 m in depth) to deep lakes (greater than 8 m). These bodies of water are generally floored with silt or bat guano, and in Cenote de San Isidro the water is contaminated with human trash and feces. Reddell (1977:258) indicated that Cueva Luchil was “badly polluted by oil and debris. Piles of human feces are abundant on the rocks below the entrance.” Water temperatures have been reported by Hall (1936), Pearse (1938), Robles Ramos (1950), and by Reddell (1977) for various caves, ranging from 23.5°C to 28.3°C. Hall (1936:12) presented chemical and physical data for the type-locality of this shrimp and for Cueva de Santa Elena; pH values were 7.4 and 6.8, respectively and those of dissolved oxygen, 6.51 and 0.78 mg l⁻¹, respectively. These data are similar to those he obtained from other localities in the region (see Hall, 1936:11). Hence, it can be concluded that *T. pearsei*, and other aquatic cavernicoles from the Peninsula, are able to tolerate oxygen levels that are well below saturation (i.e. 10%–80% levels).

Typhlatya pearsei is generally found in total darkness but occasionally individuals are seen in entrance areas where pools receive either direct or indirect light from the surface. See Reddell (1977) for other faunal elements and for a detailed description of the caves. See Table 1 for shrimp associates and Table 2 for life history data.

Color.—Preserved specimens are translucent to white; Holthuis (1977:175) noted that when alive they “are of a light, whitish, colour [sic], being somewhat opaque, not transparent.”

Variations.—Generally, specimens examined from localities other than those reported by Hobbs and Hobbs showed no significant morphological variations from published descriptions of the species. However, several males from Cenote Nohchén in Yucatán possessed an atypical second pleopod (Fig. 3A, D). The appendix masculina is much longer than the appendix interna, as the latter is proportionately shorter than that exhibited by more “typical” males from other localities. In addition, only 5 apical and sub-apical spines are present on the apex of the appendix masculina as compared to approximately 16 in specimens from other caves.

Family Palaemonidae

Genus *Creaseria*

Creaseria morleyi (Creaser)

Palaemon morleyi.—Hobbs and Hobbs, 1976:1.—Hobbs, Hobbs, and Daniel, 1977:7, 9.

Creaseria morleyi.—Holthuis, 1977:173, 186, 187, fig. 5a–c.—Reddell, 1977:230, 239, 240, 241, 243, 247, 251–253, 255, 258, 262–264, 266–268, 273, 274, 277, 281, 283, 285, 291–293, Table 1.—Hobbs and Hobbs,

1976:1, 16–21, figs. 7, 8, Appendix, Map 2.—Hobbs, Hobbs, and Daniel, 1977:iii, 6, 9, 12, 25, 46–49, figs. 18, 19.

Type-locality.—Cenote de San Isidro (Cueva de San Isidro, Cenote de El Retiro), near southern end of Calle 66 in Mérida, Yucatán, México.

Distribution.—Even though its range does not greatly exceed that of *Typhlatya pearsei*, *C. morleyi* is probably the most common cavernicolous shrimp within the Peninsula, being known from the states of Campeche, Quintana Roo and Yucatán (the Northwestern and Northeastern Coastal Plains, the Sierra de Ticul, and the Sierra de Bolonchén physiographic districts).

Specimens examined.—101 specimens were taken from 32 localities in the states of Campeche, Quintana Roo, and Yucatán; locality numbers in parentheses correspond to the locality numbers in Table 1 and Figure 1; specimens marked with an asterisk were not examined by the author. CAMPECHE: (1) Cenote de Bolchén, 3 km S San Antonio Sacabchén, 3♂, 6♀, 30 October 1974, D.M., J.R.R., and S.W., coll. (3) Grutas de Monte Bravo, 2♀, 19 December 1974, L.E., D.M., and J.R.R., coll. (4) Grutas de San Antonio, 1♂, 3 November 1974, D.M., J.R.R., and S.W., coll. QUINTANA ROO: (6) Cueva del Fermín, 1♂, 1♀, 3 July 1975, A.G., D.M., and J.R.R., coll. (8) Pozo de San Martín, 1♂, 5♀, 2 July 1975, J.R.R., coll. (9) Cenote de Juan Coh, 4♂, 6♀, 4 July 1975, A.G., D.M., and J.R.R., coll. (10) Cenote de las Ruinas, 6 km ENE Polyuc, 1♂, 6♀, 29 July 1975, A.G., D.M., J.R.R., and S.W., coll. (11) Cenote de Santo Domingo, 2♂, 4♀, 29 July 1975, A.G., D.M., and J.R.R., coll. (12) Cenote de Tos Virlool, 3♂, 8♀, 4 July 1975, A.G. and J.R.R., coll. (13) Cueva Coop, 1 specimen*, March 1975, H.W., coll. YUCATÁN: (14) Cenote de la Culebra, 2♀, 3 August 1973, F.E.A. and R.W.M., coll. (17) Cenote de Hochtún, 2♀, March 1969, T.R., coll.; 2 specimens*, spring 1970, H.W., coll.; 3♀, 16 March 1973, M.B., D.M., M.H.M., S.M., and J.R.R., coll.; 1♀, 29 April 1973, R.W.M. and J.R.R., coll.; 2♀, 8 August 1973, F.E.A., D.D., M.K., R.W.M., S.A.M., S.R.M., coll. (18) Cenote X-ebiz, near Hochtún, 1♀, 26 April 1971, E.H.S., coll. (19) Cueva Chac Mol*, near Tohil, reported by Creaser (1938:163). (21) Cenote de las Abejas, 1♂, 16 April 1973, D.M. and S.M., coll. (23) Cenote Kabahchén, 1♂, 1♀, 1 August 1973, M.K., R.W.M., and J.R.R., coll. (25) Cenote Calchuhum, 1♂, 1♀, 15 October 1974, J.R.R., R.S., and S.W., coll. (26) Cueva Amil (=Cenote Amil)*, on Hacienda Tixcacal, 2 km E Mérida, reported by Creaser (1936:128). (27) type-locality, 4♀, 21 March 1973, S.M. and J.R.R., coll. (30) Cenote de Sambula (=Cueva de San Bulhá)*, Motul, reported by Creaser (1936:128). (31) Cenote de Kankirixché*, on Rancho San Isidro Kankirixché, 10 km NW Muna, reported by Reddell (1977:268). (32) Cenote del Pochote, 2♂, 4 November 1974, D.M., J.R.R., and S.W., coll.; 1♀*, March 1975, H.W., coll. (33) Actún Xpukil (=Actún Spukil,

Table 2. Life history data for troglobitic shrimps of the Yucatán Peninsula (month, sex, size, range and number of specimens collected since 1932).

	<i>T. campecheae</i>	<i>T. mitchelli</i>	<i>T. pearsei</i>	<i>T. morleyi</i>
January	—	—	—	1 specimen***
February	—	—	—	—
March	—	6 ♀ 1 Juv. 4 specimens**	3 ♂ 32 ♀ 6 Juv. 2 specimens**	1 ♂ 15 ♀ 1 specimen**
April	1 ♂ 4, 2 ♀*	10 ♀	2 ♂ 14 ♀ 4 Juv.	3 ♂ 5 ♀
May	40 ♂ 109 ♀ 21 Juv.	—	—	2 specimens**
June	—	2 ♀	4 ♂ 77 ♀ 3 Juv. specimens**	specimens***
July	22 ♀	3 ♀	28 ♀ 1 Juv. specimens***	12 ♂ 30 ♀ specimens***
August	—	9 ♀	5 ♀	1 ♂ 5 ♀ 4 specimens****
September	—	—	—	—
October	—	7 ♀	3 ♀	4 ♂ 7 ♀
November	—	8 ♀	3 ♂ 32 ♀	3 ♂ 1 ♀ 3 Juv.
December	18 ♀	5 ♀	3 ♀	3 ♀
Total number of specimens	217	55	222	101
Carapace length (range)	♂—3.0–3.9 ♀—3.1–4.5 Juv.—1.4–2.7	♂—? ♀—3.4–4.8 Juv.—1.4–2.9	♂—3.6–3.8 ♀—3.1–5.2 Juv.—1.3–2.3	♂—14.0–20.3 ♀—12.3–29.0 Juv.—5.6–9.0

* Ovigerous (approximately 0.8 × 11.1 mm—egg size).

** See Holthuis, 1977.

*** See Creaser, 1936.

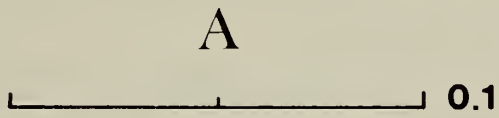
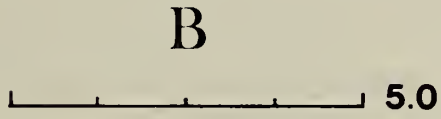
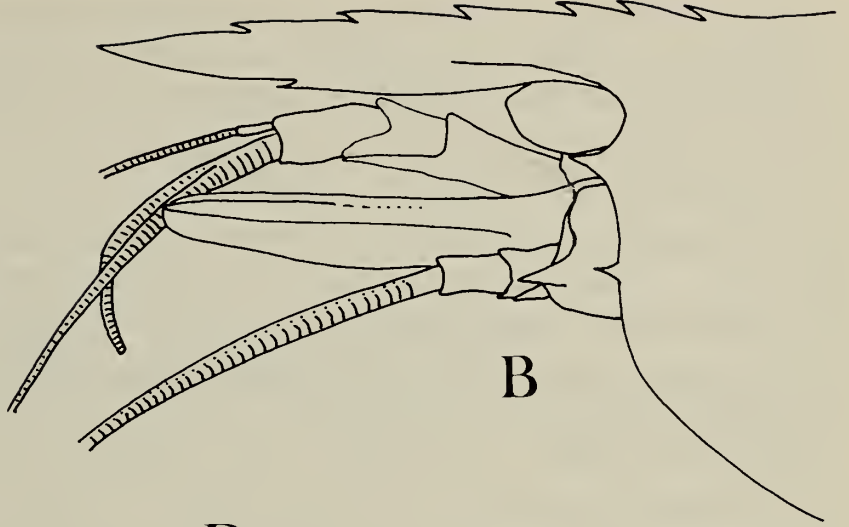
**** See Pearse, 1936.

Grutas de Calcehtok, Cueva de Oxkintok)*, in Sierra de Ticul, 3 km S Calcehtok, reported by Creaser (1938:163). (34) Actún Góngora (=Actún Góngurrah, Cueva de Gorgosa)*, 1.5 km S Oxkutzcab, reported by Creaser (1938:163). (36) Actún Chac, 2 juv., 24 November 1962, E.W.A., coll.; 1 ♀, 15 December 1962, E.W.A., coll.; 1 ♀, 1 juv., 16 November 1974, D.M., J.R.R., and S.W., coll. (40) Grutas de Tzab-Nah, 1 ♂, 2 ♀, 22 April 1973, D.M. and J.R.R., coll. (42) Pozo de Santa Elena, 4.8 km S Telchac Puerto, 1 ♂, 2 ♀, 22 March 1973, S.M. and J.R.R., coll. Hobbs and Hobbs (1976:20) erroneously reported this species from Cueva de Santa Elena and listed the locality of Pozo de Santa Elena as "5 km S Telchac Puerto" (p. 16) which, in fact, is the location for Cueva de Santa Elena. (43) Grutas de Balan-kanche, specimens* from Pearse (1936:128); 4 specimens*, 23 August 1973, R.A., coll.; 1 ♂, "1st half, 1961," E.W.A., coll. (48) Cueva Sodzil, 5 km W Sucopo and 50 m from Cenote Sodzil, 3 ♀, 31 March 1973, D.M., M.H.M., S.M., and J.R.R., coll. (49) Cueva Xconsacob, near Tizimín, 11 August 1936, A.S.P., sight record by Creaser (1938:163). (51) Cenote de la Paca, 1 ♂, 1 ♀, 11 April 1973, S.M., coll. (54) Cenote Yunchén (=Cueva Yunchén)*, Libre Unión, 11 July 1936, A.S.P., reported by Creaser (1938:163). Reddell (1977) mentioned five localities in which palaemonids were observed but not captured (see Table 1).

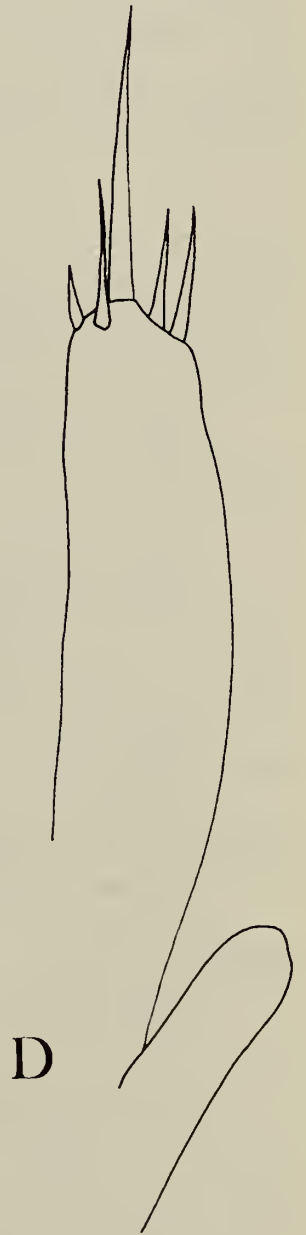
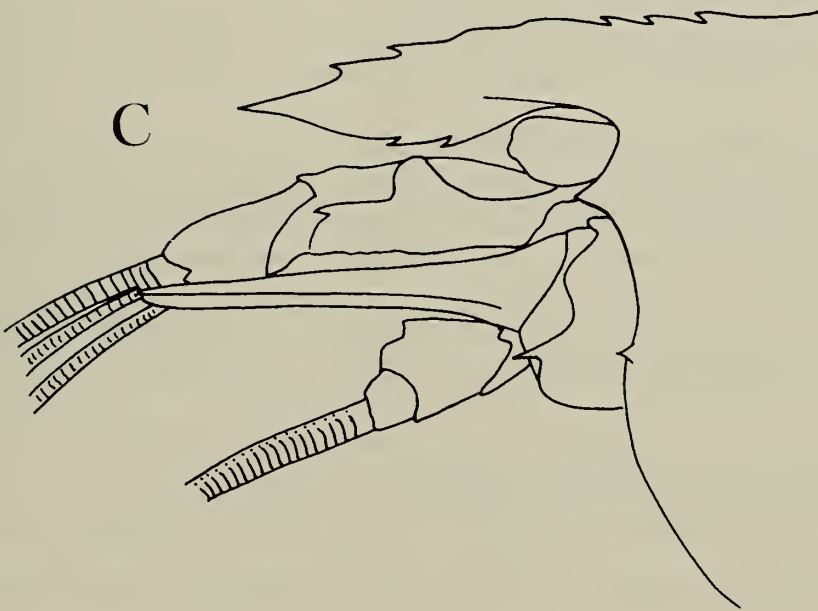
Ecology.—*Creaseria morleyi* occurs in quiet water habitats ranging from small, shallow pools (less than 0.5 m in depth) and natural wells (5 m deep) to large, deep lakes (greater than 3 m in depth). These bodies of water are floored by guano deposits, rich organic silt, debris, and rocks. Hall (1936), Hubbs (1936), Pearse (1938), Robles Ramos (1950), and Reddell (1977) reported water temperature in 11 localities and these values ranged from 23.5°–28.3°C. Shrimp were found in total darkness as well as in entrance areas receiving direct and indirect light. Hall (1936) presented physical and chemical data for some of the caves inhabited by *C. morleyi*: pH ranged between 6.8 and 7.4 and oxygen concentration, from 0.78 to 6.51 mg l⁻¹. These shrimp have been observed to crawl over the bottom of the substrate as well as to "swim" throughout the water column (Creaser, 1936 and Reddell, 1977). Creaser also reported that *C. morleyi* is quite sensitive to water vibration and that the species is cannibalistic. Holthuis (1977:187) states that "these animals are very aggressive [sic], if two or more specimens are placed together in a smallish container they will attack and mutilate each other." See Table 2 for life history data.

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Fig. 3. A. Second pleopod of male *Typhlatya pearsei* from Cenote Nohchen; B. Lateral view of anterior region of male *Creaseria morleyi* from Cenote Calchuntunil; C. Lateral view of anterior region of male *Creaseria morleyi* from Grutas de San Antonio; D. Appendices masculina and interna of male *Typhlatya pearsei* from Cenote Nohchén.



Scales in mm



Color.—Preserved specimens are translucent to white.

Variations.—This appears to be a rather variable species: particularly conspicuous are the differences noted in the second pleopod of the male and the rostrum of both sexes. The appendix interna may or may not extend to the apex of the appendix masculina, and the number of spines on the latter varies from 19 to 27. The rostrum is extremely variable, ranging from long, thin, nearly straight and not expanded dorsoventrally (Fig. 3B) to short, thick, and vaulted (Fig. 3C). Rostral spination varies in number (from 6–10 dorsally and 0–3 ventrally) and relative position on dorsal and ventral sides, and the apex of the rostrum may be acutely spined or somewhat rounded. Generally, if the apex of the rostrum reaches or extends beyond the antennular peduncle, then the spines are acute; otherwise they tend to be rounded, little more than “bumps.” As Holthuis (1977:187) indicates, “the eye is not always perfectly bullet-shaped as described, but often shows a distinct tubercle on the outer surface somewhat behind the apex . . .” and in “larger specimens the crenulated tooth of the fixed finger of the second leg . . . is distinct, the cutting edge of the dactylus bears a triangular tooth distally of the tooth of the fixed finger.”

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